DOCUMENT RESUME

ED 241 057 IR 050 667

AUTHOR Snyder, Richard L.
TITLE College Library Buildings in Transition--Looking at the 1980's.
PUB DATE 14 Oct 83
NOTE 44p.; Talk delivered before the Conference on College and Academic Library Buildings in the 80's (New Stanton, PA, October 14-15, 1983).
PUB TYPE Viewpoints (120) -- Guides - Non-Classroom Use (055) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Academic Libraries; *Building Design; Facility Planning; *Facility Requirements; Guidelines; Higher Education; Library Automation; Library Equipment; *Library Facilities; Library Materials; Library Planning; Prediction; *Space Utilization; *Technological Advancement

ABSTRACT

This paper examines the likely effects of technological developments on the planning of American academic library buildings during the 1980's and shares Richard Snyder's experiences in the design and construction of a new library building at Drexel University in Pennsylvania. Descriptions of general, economic, policy, psychological, and sociological problems in projecting technological developments are followed by an outline of design and construction considerations including modular design, library entrances, ceilings, floors, floor coverings, windows, walls, doors, HVAC (heating, ventilation, and air conditioning), acoustics, electrical power, lighting, energy usage, communications, security and safety, and future expansion. Guidelines on planning for library spaces are also provided, covering administrative organization; general space calculations; reader space; collection space for magnetic disks, video and optical disks, access to electronic publishing, microforms, reserve and reference materials, browsing and special collections, maps, and audiovisual materials; staff space; and other library facilities including public catalog areas, classrooms, exhibit space, and machine repair and photographic space. It is emphasized throughout the paper that library buildings should be designed for the foreseeable future with a maximum of flexibility to accommodate future technological changes. (ESR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED241057

IR

College Library Buildings in Transition - Looking at the 1980's

a talk delivered before the Conference on College and Academic Library Buildings in the 80's, New Stanton, PA, October 14 and 15, 1983.

By

Richard L. Snyder

Drexel University
Philadelphia, Pennsylvania

October 14, 1983

IR050667

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Richard L. Snyder

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TABLE OF CONTENTS

PURPOSE OF THE TALK..... iv

PROBLEMS IN PROJECTING..... 1

- General..... 1
- Economics..... 3
- Policy Change..... 4
- Psychology and Sociology..... 5

DESIGN / CONSTRUCTION..... 6

- General..... 6
- Modular Design..... 6
- Entrance..... 7
- Ceilings, Floors and Floor Coverings..... 8
- Windows..... 9
- Walls..... 9
- Doors..... 9
- HVAC..... 10
- Acoustics..... 11
- Electrical Power..... 12
- Lighting..... 14
- Energy..... 15
- Communications..... 15
- Security, Safety and Control..... 16
- Future Expansion..... 18

LIBRARY SPACES..... 19

- Administrative Organization..... 19
- General Calculations..... 21
- Reader Space..... 21
  - Number..... 21
  - Area..... 23
  - Qualitative Factors..... 23
  - Summary..... 23
- Collection Space..... 24
  - Area..... 24
  - Magnetic Disks..... 24
  - Video and Optical Disks..... 24
  - Electronic Publishing..... 25
  - Microforms..... 27
  - Reserve Materials..... 27
  - Reference Materials..... 28

Browsing and Special Collections..... 28
Maps..... 28
Audio-Visual Materials..... 29
Summary..... 29
Staff Space..... 30
Number..... 30
Area..... 31
Spatial Relationships..... 31
Qualitative Factors..... 32
Summary..... 32
Other Library Facilities..... 33
Public Catalog..... 33
Area..... 33
Spatial Relationships..... 34
Classrooms..... 35
Exhibit Space..... 35
Machine Repair and Photographic Space..... 35
Non-assignable Space..... 36

CONCLUSION..... 37

REFERENCES..... 38

PURPOSE OF TALK

The purpose of my talk tonight, besides trying to keep you awake, is to look at the likely effect of technological developments on the planning of American academic library buildings during the 1980's. It is my intent to share my experiences and problems in the programming and designing of a new building and to extrapolate to the future based on my readings on the topic, my interest, my background in physical sciences and library science, and the environment of a technological university in which I work. My choice as a speaker tonight is particularly propitious because dedication of my new building was held yesterday and we begin to move in next Monday. Consequently, I am full of the excitement of anticipation without the knowledge of errors.

These words are directed at college administrators, trustees and librarians who expect to launch a library building program, and to architects who entertain the idea of involvement in an academic library building project.

PROBLEMS IN PROJECTING

General

I enter into this advising on the future with some trepidation. Only the lucky can make future predictions successfully. In fact, however, I do not find the prediction of implementation of technological developments particularly difficult. What is difficult is the timing of the implementation. This becomes a matter of economic, sociological and psychological analysis.

I have seen plenty of evidence of the inaccuracy of projections in the thirty years of my professional career. When I entered library work in the early 1950's, everyone was predicting that computers would soon take over library functions. Western Reserve, uniterm, inverted files, punch cards, I.B.M., all were hot topics. I remember no projections of the radical change that photocopying would engender in the subsequent decades.

Who remembers predictions of nuclear powered aircraft, personal rocket belts, videophones, and more recently, holography and bubble memories?

I can point to my own failure in our building program--the pending, extensive use of microcomputers, by all students at Drexel.

Somewhat anecdotically, I recall the design engineer on our building planning conduit from every projected computer location to a central vertical trunk, from which the wiring would then branch throughout the building. That may seem perfectly logical, assuming we know exactly where computers and terminals will be located (which in many cases we don't), but it overlooks the chaining of OCLC terminals that requires cable to go directly from one to another. The interval now recommended is less than sixty feet; we're still using a one hundred foot line in our old building. That shortening in length means we must add a second modem in the new building, with all its concomitant expenses. So you see even technology has its reversals.

Why should I presume then, to be any more successful a prognosticator than others were decades ago, or that I was even five years ago? One thing

in my advantage tonight, since I have been asked to deal with library buildings during the 1980's, is that I am not expected to prognosticate over a long period of time. When you think about it, next year's budget will be in the second half of the current decade. If buildings planned now have a future of at least twenty years, the bad news for me tonight is that there is no way I can accurately predict their technological future. The good news is that none of you will remember my predictions anyway.

Porter Driscoll, in his article, "Architecture and the Information Revolution," states:

> ... all agree that change, whatever it is, will be revolutionary and will shape every aspect of the design and operation of the built environment.[1]

Wilford Lancaster, of the Graduate School of Information Science, University of Illinois, predicts, in his 1982 book,

> It is my belief that electronic communication will continue to substitute for other forms, that electronic publishing will largely replace print-on-paper publishing, and that libraries as we now know them will become obsolete.[2]

> ... the disappearance of the library of today may well be complete in another two decades.[3]

If he's right, then why are we here tonight?

I think it is fair to say that I take a conservative view on the impact of technology on future library buildings. I see evolution rather than revolution. Though change may be radical given enough years, I see no rapid overthrow of current systems, rather, and unfolding, a development, with the new operating with the old.

In fact, I feel evolution is essential to move a continuously operating information system from one stage to another. In my mind, OCLC was successful because it permitted us to move toward online catalogs without rupturing the old work flow as we built the data base required.

In spite of Lancaster's predictions, I think a library is worth planning and building today. Libraries will not die, at least in the lifetime of the next building, though their collections and functions will change and they must adapt as they have in the past, to new environments.

The book will remain with us for many years. It will continue to be a viable publishing form in areas such as the humanities, social sciences and recreation. It will disappear only slowly in the sci tech field. Even those libraries that dip heavily into electronic journals will maintain for some years a paper collection of receding usefulness. You may be familiar with authors that concur.[4]

In addition, I guess I take a pessimistic attitude on the future economics of library operations.

Economics

William J. Baumol, the Princeton economics professor, has recently issued an insightful article, entitled, "Electronics, the Cost Disease, and the Operation of Libraries."[5] Therein, he points out that as computer hardware costs come down, at the rapid rate of, perhaps, 25 percent per year, whole systems become more and more dependent upon software costs that are directly related to salaries. The rapid decrease in hardware cost is thus applied to a smaller and smaller share of the total cost; therefore, the fast initial decline is slowly reversed and total system costs begin to climb. Baumol contends there is a

> ... substantial residue of labor-intensive activities which strongly resists a steady rate of cost reduction, and this means that eventually this component of library cost must increase to a significant proportion of the whole. With that, the electronic library, like the conventional library, becomes fully vulnerable to the symptoms of the cost disease.[6]

May Katzen, in her book, Multi-Media Communications[7] points out that students are unlikely to be given unlimited free access to online facilities at their institution's expense. Can universities afford to drop printed versions of indexes from the collection when the undergraduate is thus deprived of their educational experience? Academic institutions are less well endowed than business organizations and have a conservativism that may well postpone the adoption of electronic information technologies.

Factors such as the decline of the student population, as predicted by demographic studies, and the return to higher energy costs will engender

stiff competition for shrinking campus financial resources. Although everyone professes the library is the heart of the University, that seems to position it some distance from the wallet.

On the positive side, as society and the nation's business emphasize information handling, libraries, which in the past have formed too small a market to look attractive to business and industry, may be able to assimilate technical developments such as office automation more easily and with less expense.

This paper tonight is not intended to be an exposition of the economics of technological implementation. But economics is important; it is one of the most powerful controls of the speed with which we can implement technology in libraries.

Policy Change

Another encumberance to my predicting is the likelihood of policy change. That forms a meld of economic, sociological and psychological issues. Take for instance, the recent decision on handling communications in the United States. It resulted in the breakup of A.T.&T., distribution of local telephone exchanges to smaller companies, and long lines to yet another company. It pits A.T.&T. against I.B.M. in the computer/communications field. This judicial decision will change the costs of technological implementation--some to our advantage, some otherwise.

The decline of educational subsidies (witness the Higher Education Act Title II) and reduction in the government's role as an information provider and disseminator (witness the GPO and other executive attitudes) are all current policies with future implications.

Even the new copyright law does not clarify well the position of computer programs, electronic publishing, data base ownership and other information technologies on the horizon. It could well encumber their advance.

Legislation to protect the handicapped has already effected library construction. In my own case, toilets for the handicapped were placed on the first floor of the building in direct contradiction of our building program. I feel that was an over-reaction to government legislative policy.

On the local level, you will be frustrated by ordinances and building codes. These seem particularly slow to accept technological advances. There has been a ten year delay in accepting cable television in Philadelphia. Also, there now exists a flat wire tape for power distribution which can be laid beneath rugs to permit duplex outlets to be cheaply in talled in open spaces. This is approved for offices but was not accepted in Drexel's library because the local code specifically excluded its use in schools. Our library was interpreted as being "a school" under the code.

So you can see how national and local policies, even policy interpretations, can affect the success of projecting the implementation of technology.

Psychology and Sociology

The acceptance of change is difficult. We will always have our Luddites. But countering their attempts to prevent change are band-wagon attitudes and fads that seem to hasten some new and innovative developments.

The advance of technology is complicated by issues of depersonalization and organizational complexity. Will the decentralization made possible by computers lead to the cottage industries so frequently predicted or are the relationships of the work place so ingrained as to delay the change through generations? Doesn't the very complexity of technology itself impede its rapid advance?

How can the paperless society be so all-pervasive during the lifetime of one, such as myself, who finds so much pleasure in curling up in some remote, comfortable place with a good book. Perhaps though, I minimize the gap between my thinking in the work place and that at my home.

All the personal and societal ramifications of the advance of technology surely humble the prognosticator. But they don't stop us!

DESIGN / CONSTRUCTION

General

Now that I have established my optimism about the future of the academic library and pessimism about the rapidity of adoption of technological change, and now that I have established that you should only believe a fraction of what you hear me say tonight, let me pursue the purpose of this talk.

I am indebted throughout to Metcalf's book on planning academic and research libraries.[8] With hindsight, I do not think I can recommend it as a beginners' manual. They don't start you in grade school with the encyclopedia. Metcalf's book scared me off in the earlier years. I would have been much better starting with Ellsworth's Planning Manual for Academic Library Buildings[9] and working my way up to the more detailed Metcalf.

Modular Design

The basic importance of modular design will remain unchanged in libraries. It reinforces the flexibility and adaptability to which I will refer frequently throughout this talk. The construction of large, unencumbered spaces permitting a variety of uses will continue, and perhaps, even increase in importance, as new technologies are adopted in libraries. I recommend the current practice of a fixed bay size throughout the building for the same reason.

Continued development in structural trusses and reinforced concrete construction has offered the opportunity for larger bays. At Drexel, ours are twenty by forty feet, about twice, in the longer dimension, what they were in the old library building.

The adoption of the metric system in the United States seems to be a slow process. As a result, one may assume that standard stack units will continue to be available in three-foot lengths. This factor must then drive the size of the bays in large libraries now being contemplated. In the long run, as electronics substitutes for the printed word, modular sizes based on three-foot stack ranges become less important. But I set that aside for the next generation of buildings.

Entrance

I see nothing in the advance of technology, or the decline of society, that will replace the appropriateness of a single entrance in an academic library. I shall speak about security in another section, but I believe exit control employing Tattle-tape, Checkpoint and new, but similar, systems will continue. Floor channels should take the system's wiring to the control units without the ramp that one encounters in older buildings.

I think, too, the Circulation Desk should be kept adjacent to the exit. A book return slot from the outside is approprate even though new formats, which I shall deal with later, will develop.

Be conscious of the interference between Tattle-tape signals and computer equipment. Salesmen tell me ten to fifteen feet is sufficient distance to prevent Tattle-tape from interfering with screen displays. Check with both vending parties to be sure. Improved electromagnetic insulating materials will probably correct this flaw in time.

Watch out for the imcompatibility between Tattle-tape sensitize/de-sensitize units and magnetic storage materials such as floppy disks.

The lobby offers an ideal place for the architect to encourage people to meet, and thus counteract the impersonal environment that will develop as more and more of the library becomes computerized.

Ceilings, Floors and Floor Coverings

Live loading of floors should be kept at the current standard of one hundred fifty pounds per square foot. That minimum should apply throughout the building to permit any part to house books. It should suffice, too, for the computers in our future.

Development of composite materials for shelving, resulting in better strength-to-load ratio is too far in the future to be helpful to current planning.

Some spaces need a loading as high as 215 pounds per square foot.[10] Microfiche and large audio, and later, video disk collections represent examples of this extreme. Their weight plus the reduced need for ambient lighting makes a basement the area of choice for microform and A.V. collections. Sometimes that location cannot be used and strength above 150 pounds per square foot will be needed on the upper floors.

Cable channels in floors, for communications and power, offer flexability but are still relatively expensive in the quantities we desire. Some feel they limit data wiring expansion too.

False ceilings hiding heating and cooling ducts, and power and communication cables add to the space needed between the ceiling and floor slab. This, in turn, adds to the cubage and thus subtly to the cost of the building although it contributes to the flexibility I feel so essential.

We were pleasantly surprised at Drexel to find a small elevator moving one person and a book truck between floors was as cheap to install as a book lift.

The acoustic and aesthetic values of carpeting are already clear. At Drexel, we have installed eighteen-inch carpet tiles that the architect has assured us are ready for heavy institutional use.

Carpets with electrical conducting threads that reduce static electricity are available but expensive. Astatic carpets should be considered when you design your building because of the increased use of computer equipment, so sensitive to static electricity. Rubber astatic mats are a less satisfactory solution.

Windows

Your architect will have to be aware of the problems of reflections from windows, and other ambient lighting such as sky lights, on computer terminals though in time I expect terminal design will reduce glare problems.

The difficulty can be moderated by tinted glass, and fortunately that, too, can assist energy conservation. Thermopane glass should be used for its heat and sound insulating values.

The windows should open to tempe. air conditioning failures.

Walls

To conserve energy, the outside walls in a library should be heavily insulated. At Drexel, this was done, but steel studs were used as vertical members inside the brick facade. A Drexel physics professor has since found that this use of steel studs offers excellent thermal conduction to the out-of-doors and reduces the effectiveness of the intervening insulation. Obviously, there is a lot to learn in this field. Thermal insulation also serves as acoustic insulation so it may be used in inside walls too.

To reduce later costs, walls should be built with conduit where communication and power lines are anticipated. You will undoubtedly be able to project many locations where you can expect a computer terminal or related device to be placed. Unfortunately, such conduit installation costs money and you will not be able to afford all the installations you would like. Choose judiciously and expect to be wrong.

Doors

Be sure that doors are wide enough and elevators deep enough to accommodate new equipment such as minicomputers and large photocopiers.

In spite of Star Trek, I don't see doors changing very much in the near future. Motion detectors to open them are already feasible, and costs

should decline, but watch for temperature variations in the lobby. In Drexels's new building, those drafts are to be controlled by a pair of revolving doors. The success of that solution is yet to be measured. A pair of regular doors were also required for the handicapped.

HVAC

I cannot improve upon Metcalf's discussion of heating, cooling, humidification, filtering and so forth, except to indicate some places where he is dated. In the first place, he makes no mention of computers in his HVAC section. Secondly, our consciousness of energy conservation has been raised considerably since his book was issued. And thirdly, with a noticeable dating, he speaks as if air conditioning was still an option. Technological change of heating, ventilation and air conditioning (HVAC) will probably be merely a refinement of the state-of-the-art. But control of these systems continues to advance.

At Drexel, library departmental hours are all carefully programmed into a computer and it automatically shuts down zones in the building just before their closing and brings them up just before opening. When we shift hours between terms, we hope Physical Plant remembers to make the change. In theory, the HVAC manager has a terminal, even at home on weekends, so that a telephone call can inform him of adjustments he should make. Depending on the building, such an installation will save its cost within one to one-and-a-half years by reduction of energy use.

Any building under construction or design at this point must anticipate effects of heat from extensive use of terminals and other equipment. For example, specifications say as much as 10,000 BTU's per hour are emitted by a running Xerox 7000. Heat generation is even obvious in small spaces with a high density of terminals or microcomputers.

Salesmen will tell you minicomputers are designed to operate in the temperature and humidity environment comfortable for humans. Doubt that! But they have come a long way and future designs will make them even more tolerant of the environment. Nevertheless, they generate heat and if

confined to a small room (say 250 square feet) as is common because of their noise, security and so forth, they may raise room temperature 5°F. An outside wall offers easy supplemental air conditioning or venting, though large windows there would permit heat from the sun.

The location of computer equipment in your library's future should be documented during the design stage, so that HVAC can be built to adjust to their installation. Expected growth in their numbers should be known to the HVAC design engineer.

At Drexel, even with the new building, we have a high proportion of our collection in remote storage. That closed stack area need not be fully heated. The deterioration of books is a chemical reaction accelerated by high temperatures. Large stack areas, then, can be cool if not shared with patrons. Air conditioning should remain.

Although perhaps appropriate under the next topic, Acoustics, I should also mention here the advantages of designing a HVAC system which creates white noise. The gentle flow of air over vents can create a steady background which the mind ignores. In the M.I.T. Science Library, only when the ventilating system ceases is one aware of coughs and other incidental noises.

Acoustics

Metcalf tells us that prevention of noise is better than absorption, but there are some noisy areas that cannot be eliminated from a library--the Circulation and Reference desks, and the traffic around the card catalog and entrance. These spaces are best isolated from areas that should be quiet because improved floor coverings, acoustical ceiling tiles, sound absorbent walls and other treatments are unlikely to be sufficient.

Noisy computer output equipment is in the Library's future. Printers are going to proliferate at online catalogs, data base service locations, at the Circulation Desk, in Technical Services, and even among readers using micros.

In the latter case, printers in a closed, adjacent room may be appropriate. A single printer can serve several users and its isolation is thus logical. With fewer printers, the Library is then more likely to be able to afford a faster, more expensive machine which may also be the quietest. Ink jet printers offer hope; I saw one advertised for under $600 dollars recently.

Electrical Power

Identify the location and nature of each piece of equipment--present and future--and whenever possible, supply the equipment's specifications to your design firm's engineer. Information such as the equipment's voltage, amperage, physical dimensions and need for dedicated feeder lines is essential. Don't worry that the brand or nature of the equipment may change in the interval before use. The building's design will probably accommodate any subsequent piece with the same function.

Make it clear in the program that expansion is expected. This is particularly true for computers and terminals. And warn of second-phase growth such as the need for additional disk storage on minicomputers, and printers for terminals.

But what about the equipment you cannot even anticipate during design? For example, we now expect to have microcomputers in quantity at Drexel. Hope your building flexibility pays off. Use your intuition. We requested a phone jack installation at the end of one big room in the Non-Print area though there was no phone anticipated. That guess will now simplify installation of communication lines between micros and campus minis.

And remember, nobody else is anticipating installation of equipment properly either. As a result, new equipment is usually designed so that its dimensions, weight, electrical and environmental requirements need few corrective measures.

Be conscious of the need for emergency/backup power. We face a period of implementation of electronic technologies at the same time we look to rising energy costs, and inadequate power generation. New developments in

batteries will help counter the problem, but think of your future library in a brownout. What equipment is essential? Students may be able to study near windows enabling some library use in a power failure. Therefore, shouldn't the Tattle-tape system be on an outlet supplied by the emergency generator? How about at least one of your online catalog terminals? Emergency power will be constrained by the costs justified in backup diesel generators, for example, but identification of power requirements beyond your local building code should be spelled out in your program and negotiated during the design phase.

Emergency power for computers includes a system called an Uninterruptable Power Source (U.P.S.) using co-generation. Normal power drives an alternator which removes spikes and noise in the computer line. At power loss, the system is thrown to a battery within a second. More cost; more non-assignable space. I refer you to useful citations such as Brownrigg, PALINET, and Stroum[11] for details on computer installations. Actually, I think both Brownrigg and Stroum's articles may overdesign computer spaces because by the time buildings now in the planning stages are constructed, the environmental tolerance of computers will be markedly improved. Design your space, where computers are expected but not planned, to be easily upgraded to the level proposed in the above articles, but don't necessarily install all the specialty items yet.

The PALINET memo speaks of four three-pronged electrical outlets per terminal. Believe it and program accordingly. Micros and their peripherals make the same heavy demand for outlets. Make sure unanticipated installations are simple--for example up from the false ceiling below.

Until there is improved electromagnetic shielding, watch out for interference with terminals, micros and minis, from motors for elevators, emergency diesels and by Tattle-tape units. Avoid the proximity of power lines and low voltage communication lines.

Computer control is important for electric power too. Billing rates are often dictated by peak loads so computer control of demand and consumption by staggering the starts of large equipment is appropriate.

And trust your design group's engineer because you can't be expected to be a specialist in all these factors anyway.

Lighting

Metcalf had so much to say about lighting that he even wrote a separate book on the topic.[12] But many things have changed since that time, not the least of which has been the slowing of the trend to brighter libraries. Energy conservation, has reinforced the concept of task lighting. Yet task lighting is in conflict with building flexibility. Flexibility is so important in the library that there must be a serious search to compromise the two needs.

I have heard of several techniques of saving energy in stack lighting. Automatic timers turn off a section of lights after a given number of minutes. Motion detectors light stacks only when they are occupied. These applications would seem to be restricted to large libraries with extensive stack areas.

At Drexel, the lights throughout the building are automatically shut off in zones not scheduled for use. Buttons to override the system for half hour periods are placed in the area so that overtime workers are not inconvenienced too much. Be sure such systems do not control the duplex outlets that power computer equipment, though.

Minimum standards for emergency lighting will be specified in your local building codes. But think where else you want it. The circulation desk, for example, should at least let people charge materials out during a black-out.

I have heard good and bad things about high intensity discharge (HID) lights. These fixtures are cheaper to operate because they give more light per unit and pack that into a smaller space than fluorescent or incandescent lighting. In our library, they will be housed in cylindrical kiosks and their light will bounce back from the ceiling to illuminate indirectly. It is too early for me to comment on their use.

Energy

I have spoken about energy and its conservation under the topics of economics, HVAC, power and lighting. The subject is, and will continue to be, very important but not one over which the librarian can exercise much control.

Expect your design engineer to cost out the various fuel and energy options available to your library building, but trust their, and your campus administration's judgement in the final decision. That type of study for Drexel showed solar energy did not offer the twenty-year payback period sought. I don't know when that breakeven point will be reached but, even in Pennsylvania, it may happen in the lifetime of your new building.

Passive energy conservation can be designed into the building sometimes without extensive cost; the choice of site can have important energy implications too.

Communications

Communications ranks with computers as a technology of importance for academic libraries. We have been introduced to networking, to the searching of bibliographical and numerical data bases and to the beginnings of full-text storage of journals. Videotex and interactive television may even be in our future.

Development of standards such as hand-shaking protocols is opening up a multitude of systems to a variety of hardware. A single multi-purpose terminal now linked through packet switching networks can access masses of material. Witness, too, OCLC's plan to use I.B.M. PC's.

Communications developments over the next twenty years will be extensive and expensive. As an example of the influence of national policy decisions, I can cite the recent breakup of the A.T.&.T. complex. Where formerly, construction included a great deal of superfluous telephone lines, our local Bell company now requires a specific order for each line installed. Costs are proportionately higher for extensive telephone wiring, so you probably won't get it.

The development of fiber optics will increase signal rates to between one million and ten million megabits per second. The systems are not sensitive to the electrical interference to which I have referred so they offer both high speed and reliability. At present, the fibers are difficult to splice and the signal-to-line equipment is expensive, but when this technology becomes generally available, and it is already in service in the west, electronic communications with the world outside the library will have reached a new peak. That's a step toward massive, fast and cheap electronic journal delivery.

Cable access to the basement cannot be ignored in choosing a building site. In an urban situation, the laying of cable may cost up to $1000 dollars per foot; excavation in solid rock could be more. Conduit for wires should extend from a basement entrance through sleeves between floors all the way to potential roof antennae. Satellite communication may become appropriate because costs are independent of distance.

Security, Safety and Control

Academic libraries, especially those in the urban situation, will become increasingly popular targets for theft as sophisticated equipment is purchased. Security and safety, then, are ripe for the application of sophisticated, cheap, microprocessor control.

At Drexel, the announcement of our microcomputer program attracted thieves like a picnic attracts ants. Until microcomputers come much closer to saturating their market, we will continue to be vulnerable to theft. Few of us worry much anymore about calculators, and I think other popular library equipment will follow the same evolution. Still, choose for your environment: magnetic I.D. cards to screen library users, T.V. cameras to scan your loading dock for illegal exits and entrances, ultra-sound or infra-red motion detectors to foil illegal occupants, and silent alarm systems signaling an alert to campus police. I can see the day in our future when door locks will be automatically controlled by computer as our lights and air conditioning are already.

Watch out for systems which use a voltage spike to signal the alarm. That will be incompatible with the use of computers.

Since vending machines that talk have already been developed, there is no reason why they could not have a noisy "Help-Help!" programmed into them to sound when they are being jimmied for theft.

Smoke and heat detecting units should be installed throughout your building. These can control ventilating systems to prevent the spread of fire. If sprinkler systems are forced upon you by local codes, you will be comforted somewhat by the availability of pre-action sprinklers. These systems do not store water near the sprinkler heads. Rather there is compressed air in the system. When a fire is detected by a supplementary device, water enters the system and an alarm is sounded indicating the location of the problem. Water will not flow into the open until heat activates a sprinkler head.

Computer room fire control is discussed in the literature. Brownrigg's article,[13] and another by Balogh,[14] can be helpful.

Water-detecting units can be cheaply installed to forewarn of leaks. An interesting incident at Drexel highlights the confluence of some of these security problems. A couple of years ago, we bought a small, turtle-shaped water detector to be used in a mechanical room where a pair of doors let rain pool when the wind was right. The detector was so sensitive that when I wet the tips of my fingers and made contact across the two electrodes, it issued a loud alarm. Our model did not signal to a central location but was battery-operated and located near the path of the roving guards so that they would be alerted by the loud alarm. We never really found out how it worked because it was stolen within a few weeks.

At Drexel's circulation desk, there is an annunciator board which will pinpoint on maps of each floor, sprinkler problems, fires, or exit security breaches. We hope we don't use it.

Future Expansion

If Lancaster is right, you need plan no future expansion for your new building. But he may have predicted our demise too early. So it is only sound management that you use a site and architectural design that do not close your options.

If you get enough space in this new building, it may be all you need. If the economics and demography of higher education continue as predicted, universities will not be adding degree fields and expanding. New formats to compact information storage; the precedence of access over ownership; improved document delivery; mechanized circulation to identify, retire and withdraw little-used materials; and the growth of electronic journals will all contribute to the stability of academic library size. If the nation's economy returns to that which permitted the academic library's fast growth in the 1960's, technology will be hastened and so will the development of alternative formats for the communication of information. As a result, we will not see a return to the large acquisition rate of print material that was evident in the 1960's.

Future expansion? Perhaps not, but don't burn your bridges.

LIBRARY SPACES

Adminstrative Organization

Among the most important decisions you will have to make which will affect the lay-out, collection locations and assignment of staff within the building, are those of administrative organization. Are branch libraries to be created or merged into the new building; should service function around a subject divisional structure, or around format units such as documents, books, periodicals and A.V.? Most likely, the conclusions will be a melange of the above possibilities. But bear in mind too, the likely impact of technology upon library organization.

The continued implementation of computers, communications and networking in the library environment will permit decentralization. Decentralization will affect the library user, by providing him, for example, remote access to the online catalog. It will effect the librarian by allowing the restructuring of workflow and organization.

Will technical services need to be retained as a group of totally separate departments? Can subject specialists select and order an item and undertake much of the cataloging on a terminal in their office that puts them in touch with vendors, cataloging networks, authority files, shelflists and the local catalog? Will we need large technical services areas when, perhaps, staff commitment to public service would be a better investment of manpower? Don't we already see the blending of public and technical services in administrative units that receive, check-in, and offer reference services for specialized materials? Government documents departments are examples.

As electronic journals develop, fewer and fewer titles will need to be selected, acquired and checked in at a central location. We may not acquire materials in anticipation of use but only upon the identification of need. As a result, binding and mending become less frequent; interlibrary

loan becomes appended to reference searches; and word processing, electronic mail and local area networks reduce the need for secretaries and mail clerks.

You can see from these examples that the administrative organization of the the Library is likely to change. But when and how are different matters. Frankly, I do not have an answer. I do not see an immediate impact of the new technology on administrative organization because the technology is not yet in place, and psychological and sociological elements will complicate any change. Smaller academic libraries may be able to re-organize in an entirely new way and, by proving the advantages of new administrative structures encourage the larger of us to also convert.

What does that conversion mean for the library building? I am reminded of the real estate agent who reaffirms that the three most important things about purchasing a home are location, location and location. In the library building, the three most important things are flexibility, flexibility and flexibility. Design your building for change, and remain alert to the direction these changes may take.

I think our current logic of placing technical services on the first floor near the public catalog and reference services can be defended in spite of Penn State's move to the opposite configuration. If the two departments are blended functionally, there can be a conversion of adjacent spaces rather than a squeezing of staff into a previously fixed reference department size.

So you see administrative organization is a key decision point in any building program, and unfortunately, one of the most difficult to forecast. Major distortions of current library organizational structures may lie in your future, but you cannot be faulted for mis-designing the Library with the limited knowledge you have at this point. I repeat, however, flexibility, flexibility, flexibility.

General Calculations

There are three key elements in designing library space. One is quantity, or area, the second, relative location or spatial relationship and the third, qualitative features. Shortly, I should like to speak about these elements under the topics of readers, collection, staff, other support areas and non-assignable space. But first let me speak in broader terms.

To arrive at the rough estimate of the size of your library, there are a series of formulas that may be used. One succinct algorithm for estimating the size can be found in Mark Mitchell's article, "The Architect as Library Planner."[15] Similar models can be found elsewhere in the literature.[16]

These formulae estimate reader space, collection space, and sometimes a third category of ancilliary and support space to arrive at net square feet. From that, one may further estimate the gross square feet of the desired building. Mitchell's formula offers a framework which permits me to analyze each factor that contributes to space need.

Reader Space

Number

To calculate the total space for readers, you multiply the number of readers to be seated by the average number of square feet required for each reader.

Simple as it is, that calculation, like many, requires subjective judgement to determine the numbers to be used. For instance, calculating the number of potential readers may require you to enumerate the categories of users such as students, faculty and outsiders, or sub-categores such as undergraduates, graduates and other special groups. The number of users in each class may grow or shrink--more as a result of demographic factors than the technology discussed here.

To make a choice on what percentage of the potential reader population you should seat, you need further subjective judgement. Here I think technology will have some impact.

Faculty, and to a degree, graduate students, have normally been provided office space on campus. The library has tended to be the undergraduate's equivalent of office space. A change in that practice is unlikely, and since undergraduates are the dominant category of readers, the number of reader stations should not be expected to decline until online library services are ubiquitous and cheap.

Individual microcomputers owned by the students may draw them away from library studying. On the other hand, if the University policy is more like Carnegie Mellon's than Drexel's, there may be a pool of microcomputers or terminals in the Library that will add to the normal seated population.

Later, as online catalogs are developed and campus communications improve, faculty, and to some degree students, can be expected to visit the Library less frequently. In the long range, the Library's resources will be available to them in remote locations, and reader seating could, therefore, shrink.

In the short range, the number of reader stations would tend to increase with the introduction of specialized pieces of equipment. You are all aware that a microfilm reader commits that space to a dedicated use and will not comfortably accommodate the general reader. Though lounge space may be used for studying, sleeping and visiting, it cannot satisfy a reader who needs to view slides. Each specialized use of reader space increases the number of seats required in order to accommodate that function's peak load. As microcomputers, data base searching terminals, printers, videodisk readers and other specialized equipment are added to equipment now common in libraries, the number of total reader stations will have to be increased. Obviously, you cannot satisfy all users during periods of peak demand, but you must have a high satisfaction rate for each specialized function.

These considerations aside, economics may control the number of reader spaces in your library. At Drexel, the project budget had more effect on the seating capacity of the building than any sophisticated formula. The need to accommodate short range predictions may dominate your planning. Do the calculations and adjust them in accordance with your feeling about what the total number should be. Fine tuning is unnecessary considering all the unknowns that will affect the Library's use in the future.

Area

Returning to the formula, let us look at the net square feet assignment for each reader. Here, too, there are many qualitative factors which guide the choice of the numbers. As I said, we can expect a larger variety of equipment, plus a greater percentage of reader space to be equipment bound. Thus the average area per user may be forced upward to 30-35 net square feet.

Qualitative Factors

Now let me discuss qualitative factors. What kind of space do you intend to supply for your users? What is the appropriate mix among carrels, tables for four or eight, lounge furniture, group studies, faculty studies, and so forth. It seems to me that technology will require more individual study spaces. These spaces must be large enough to accommodate the micros and terminals that seem inevitable. Lounge furniture should continue to be popular. I suggest you consider a standard, multi-purpose room to serve as group studies, faculty studies, copy machine rooms, preview rooms for A.V. materials or potential offices, printer rooms, etc. Access to typewriters, often a service of academic libraries, will probably be replaced by access to micros with word processing programs.

I would be disappointed to see it, but the introduction of micro-computers and individual terminals for users may bring a return of reading rooms within libraries. Concentration of equipment there offers additional security, simplifies answering questions concerning equipment and the system it accesses, and centralizes the communication and power wiring.

Summary

So I return again to the formula. Short range predictions of reader spaces may dominate your planning. An increase in the number of seats to accommodate peak use at the variety of specialized reader stations seems

appropriate. In the long range libraries may seat fewer readers because of the new technologies.

Individual spaces for readers should be commodious in order to house the new equipment libraries will install as use patterns change.

Collection Space

Area

Mitchell's formula for estimating collection space divides the number of volumes by the density of storage in volumes per net square foot. That formula is straightforward if you are only accommodating print material. It is weak, however, in that it does not take into account the variety of formats customarily housed in academic libraries. Nor does it anticipate new formats and other technological advances that will influence the numbers of volumes likely to be held. What are some of these newer formats?

Magnetic Disks

One format, relatively new for libraries, is magnetic disk storage for microcomputers. This format will become more common as microcomputers proliferate in higher education. Typically, this is a multi-media material because the disks are usually accompanied by printed manuals and special "reading equipment" is required.

These magnetic disks may only be an interim stage soon to be supplemented or replaced by optical disks.

Video and Optical Disks

Videodisk technology is confusing because there are several techniques of recording on the disk. Capacitance electronic disks (CED) were developed by RCA. A diamond stylus moves in narrow grooves to play back a movie, for instance. This format has the longest playing time and the cheapest system

costs for the consumer so far, but the least ability to be made interactive.

A competitive storage format is optical encoded disks, or laser disks. These may be reflective or transmissive. With the former, a laser shines through a surface layer onto an inner layer where data is stored by small pits or bubbles. The beam is reflected back toward a detector which then converts the presence or absence of light into an electric current. These disks are protected from surface damage and obviously useful for archival storage.

The optical transmissive disk, that laser light shines through, is more accurate than the other types, but consequently, more expensive.

Digital audiodisks use a laser beam to convert digital signals to play music through conventional hifi systems. They will substitute for the long-playing records with which you are familiar. Eventually, digital audiodisks will replace long-playing records just as LPS replaced 78 RPM's.

Optical disks are useful for educational materials where, frame by frame, they may show text or pictures. Each of the 54,000 tracks on a side corresponds to one videoframe. Each frame has a unique address permitting indexing, forward and reverse sequencing and other interactive capabilities. When converted to images of a printed page, the density is variably reported at from 2000 to 36,000 pages per side. A key long range advantage of optical disk technology is its ability to be linked to computers as a substitute for magnetic digital data.

Robert Barrett, in his chapter on optical disks published in Katzen's Multi-Media Communications, concludes that

> The most likely forecast at the present time, is that digital optical recording systems using thin-film discs will be viable by 1985/86 and will be presenting major competition to COM and magnetic tape storage systems by 1990."[17]

That development will be in time to play a part in library buildings currently under construction or design.

Electronic Publishing

The third category of materials affecting collection storage is almost a non-format. By that, I refer to the future of reference data bases

and electronic journals. You are, undoubtedly, familiar with the first and may have read about the latter.

David Brown, in his chapter[18] of Katzen's book, reviews a wide range of electronic data delivery systems. Alternatives to the print journal in engineering and science have long been proposed. Now, new technologies such as 1) computerized storage and retrieval of full-text, 2) cheaper and more effective telecommunications through fiber optics and satellite transmission, 3) digital optical disks for data storage, 4) pattern recognition technologies for digitization of illustrations, graphs, etc., give hope for new systems.

Meanwhile, full-text publishing, as exhibited on LEXIS, the news reports on NEXIS, and the American Chemical Society journals on BRS, move us a step further. But Brown concludes,

> ....that there is fortunately a conservatism in information gathering which will maintain the future existence of printed journals come what may. Their portability and general convenience will suffice to give them a future. Nevertheless, document delivery incorporating some aspects of new technology will also become a feature of the scientific and technical information environment in the foreseeable future...[19]

Initially, we can expect the newer formats to be supplementary to those already received though some will be discontinued as were 78 RPM records. However, how many of you still have microcards in your collection? Like so many formats developments in the past, I project that electronic journal publishing will be only an added product, not a substitute or total replacement, during the life of your new library building.

In calculating collection space, then, you can probably assume that the publications of books will continue into the distant future, and that their purchase by libraries will be controlled more by economics than technology.

The acquisition of journals, on the other hand, will decelerate in the near future because of costs, and improved document delivery systems; in the more distant future, electronic publishing. The trend will be evident first in the Sci Tech fields but comprehensive substitutions will be slow.

The acquisition of electronic journals will theoretically reduce the

space necessary to store journal titles and also have an impact on technical services. Direct access to those journals may be gained from the faculty member's office, but it also may result from reference service following data base searches.

Microforms

Microforms, now a large part of journal storage in academic libraries, will be affected by the electronic journal and the development of optical disks. These disks' digital reproduction of images, while not searchable by computer, will offer rapid image transmission. The decline in the acquisition of microfilm seems likely, just as bound volume collecting will decelerate. But both microfilm and fiche will remain an active part of the collection for years to come.

Microfiche offers an example of what I talked about before. Fiche has supplanted large quantities of government documents. This is not a new technological conversion but parallels the type of change I expect to see. The fiche have reduced but not eliminated our print storage problems while increasing microform storage problems. At Drexel, we put the microfilm collection on the same floor with the bound journals. It was easy to predict the dominant flow between those formats. We were, however, fortunate in placing document fiche near the hard copies.

Reserve Materials

Reserve materials are a case where new technology is already having an impact on Drexel's library. During the last fiscal year, we spent about $10,000 dollars on microcomputer software. During this initial period, the software has been for faculty use only.

Based on our limited experience, the Library's Reserve Book procedure, with minor variations, appears to be a reasonable treatment of this new format. The closed stacks has provided more security for software than for hardware.

While I am on the subject of Reserve, I would like to say that library design should include slightly more closed stack space than we have been used to. New formats such as software for microcomputers may, in their introductory period, need added security.

Reference Materials

We will see a reduction in the number of printed reference materials. Data base searching is the wave of the present for secondary sources. Numerical data bases will follow this trend and will supercede handbooks and other statistical materials. Initially, perhaps, the reference staff will have to be augmented, but eventually, user-friendly systems will permit the ultimate user to access online reference materials. But why we should expect students to be any more sophisticated than they are now is hard to say--even with the advent of friendly computer systems. I expect the reference librarian's role of interacting with information and the user will continue far into the future.

Browsing and Special Collections

For obvious reasons, mechanization will not have a great effect on special collections. Their very nature and use protects them from new formats, until they too become museum pieces.

Browsing books may offer a welcome change from the varieties of electronic formats that will be developing in other parts of the collection. Their nature seems to assure longevity.

Maps

Maps will probably be produced in print format for years. At the present time, technology cannot adequately display maps, and even when

projectors of sufficient resolution are developed, the use of maps in the field by geologists and civil engineers will continue to require print format. Plan their storage space accordingly.

Audio-Visual Materials

Metcalf is weak on Audio-Visual coverage but I consider distribution (not production) of that format to be a library function.

Films, filmstrips, slide sets and related multi-media sets will surely succumb to optical disks. If we could afford it, we could transfer Drexel's whole slide collection onto one half of one side of a videodisk. Unfortunately, we are not likely to use that format because the original creation of the master is too expensive and because of copyright complications. However, institutions with large collections of slide material, such as museums, or perhaps, Harvard's Architecture Library, might be able to master their collection and reproduce enough disks for a multitude of libraries. They should, of course, incorporate the collections' indexing on the disk and overcome the potentially serious copyright problems.

A.V. storage is already such a mish-mash of formats that one more of dense storage will have little impact.

Summary

In summary, we can look forward to the introduction of new formats and the simplification of access to remote data. However, most current formats will not be eliminated. These trends require that stack areas be prepared to adjust to varying quantities and types of library materials. That will require the flexibility to introduce new storage equipment and new equipment for reader service.

Staff Space

Number

Mitchell's equation identifies the third type of library space as Ancilliary and Support. Here, he lumps together staff and service areas such as that for the card catalog in a single factor representing 50 percent of the sum of reader and collection space. Other standards choose to identify staff space separately by multiplying an average area per staff member by the number of staff members expected.[20] Many standards vary the areas by type of position.[21] Again, let's analyze the equation's parts.

To date, the application of technology in libraries has permitted a reduction of clerical positions. Tattle-tape replaced exit-checking guards; OCLC replaced catalog typists; CLSI replaced clerks. The trend will continue. There will be less card filing, mail routing and fewer secretarial chores as mechanization is applied; less journal check-in, reshelving and circulation as new formats develop. The ratio of professional to clerks may approach one-to-one.

Any trend for technical services staff to decline in number will be resisted because we will want to choose better service first--such as adding more of our local holdings to the online catalog. Furthermore, the decentralization and melding of reference and technical service positions suggested earlier does not mandate an absolute reduction in staff size, though it may require flexibility in spatial relationships.

Driscoll,[22] using professional engineers as an example, predicts that fewer people will be required to do information work because of computers. But I am not convinced his prediction is correct for libraries in the immediate future. In the long run, there may be fewer professional librarians as a result of technology, but the opportunity to expand service rather than decrease numbers will be a likely, early option. With contradicting trends, economics may be the controlling factor rather than technology.

Area

Like readers, staff will also increase their use of specialized equipment such as terminals and microcomputers. Thus, the higher estimate of current standards for staff space should be used in planning--say one hundred square feet for a clerk versus eighty. On the other hand, miniaturization of equipment and the reduction of paper, whether it be less correspondence or fewer printed works, could reduce the average area per person. So perhaps, you should program by the accepted standard areas for staff work stations--and pray a lot.

Spatial Relationships

As for the spatial relationships of work areas, I refer back to my discussion of Administrative Organization. In the short range, professionals may move toward public service work thus reducing numbers in technical services. It seems appropriate that public service offices be programmed adjacent to technical services to permit convenient renovation as staff responsibilities ebb and flow.

Locating public service offices in areas that are easily accessible to the users will be necessary until electronic communications improve considerably.

Many futurists predict an evolution of the workplace from central buildings to a home. I doubt it will come about during the lifetime of your next building because of the sociological change it would require. I am sure my wife would get a job away from home if she had to put up with me each full day; so there would be no net change in commuters. If data bases and communication systems are extrapolated, then one could conceive of librarians operating in a cottage industry. But in that case, why not dial direct to a data base expert at the Library of Congress or BRS for their specialized consultation.

I agree with Lancaster[23] that subject specialists in the library might migrate to the academic departments to work more closely with professors.

Terminals in such a librarian's remote office would permit access to catalogs and in the short run, to document delivery services. Later, electronic journals could reinforce the arrangement.

Qualitative Factors

Driscoll, speaking as a typical architect, warns of the adverse effect of electronic isolation and the need to compensate for this with quality design of the environment in order to encourage productive chance meetings and exchange of ideas.

His point is that machines in our future will make intellectual work more like a production line. In libraries, staff will spend longer and longer periods at terminals and have less and less variety in their work. This will be especially true for clerical employees. Allow for it in design amenities; arrange the layout appropriately, create coffee corners, and design a staff room as pleasant contrasts to the mechanized atmosphere. Offices for professionals will help counter that atmosphere better than office landscaping within large areas.

Unfortunately, the prediction of a larger percentage of professional staff coupled with their preference for private offices means less flexibility in the design of staff space. Let your conscience be your guide.

Summary

In summary, the near future probably controls the number of staff and the area to be programmed for them. Plan space for those positions known to be needed now, and for those likely to be established in the near future. Let those multi-purpose rooms I spoke of and judicious design of spatial relationships be your safety valve. Clerical space can be expected to decline. The need for professionals in public service may increase in the near future and possibly decrease later.

Current liberal standards for work station areas should continue to be applied. Locations of work spaces in relation to one another will be influenced initially by the possibility of a changing administrative organization, and later by communications advances.

Other Library Facilities

The fourth type of space I have chosen to outline is other special library facilities, many of which represent the confluence of the three previous spaces for staff, collection and readers. This category, too, falls under the Mitchell's Ancilliary and Support space.

Public Catalog

The Public Catalog is one of the most important of these spaces. Recent articles by Graham[24] and Brownrigg[25] dealing with the technology (including optical disks, computers, networking, electronic publishing, etc.) and likely effects of online catalogs are helpful.

But how much space will an online catalog take in the new library? First, let us deal with the number of terminals. An article by Knox, entitled "Predicting the Number of Public Computer Terminals Needed for an On-line Catalog: A Queuing Theory Approach,"[26] can be of assistance in making an estimate. But actually, few of us know how many terminals will suffice. Use patterns of an online catalog may be totally different from that of a manual catalog. You can expect each student generation to initially play with the terminals and cause queues.

Area

I think most terminals should be at stand-up tables with one or two others, depending on the size of your library, for sit-down, long-term use. Thirty to thirty-five square feet will be sufficient area depending on the density of printers.

For a small library, the total area will probably exceed that needed to house a card catalog; for a large library, online terminals should use less space than a card catalog. But remember, you may be using both catalogs in parallel for a while and you may have to house a minicomputer for this function.

Spatial Relationships

The main public catalog terminals should be unobtrusive but in plain sight near the entrance and the reference desk. In early years, they will remain the first step in approaching the stacks and should be located accordingly. Terminals at the circulation and reference desks might use lazy-susans so that the screen can be viewed both by staff and patrons. Other terminals can be scattered throughout your building, but these secondary locations can only substitute in part for the number at the main public catalog.

The secondary locations should be clustered, preferably near the entrance to a stack area. That way they will be seen, and if one terminal is down, it is easier to verify, use an alternate, and repair.

If the online file is remote, or if you choose to permit searches of other catalogs to supplement your own, then clustering also simplifies modem use and the installation of communication lines.

You might stack your clusters one above another on different floors to simplify power and communication line installation.

Terminals near walls have the advantage of easily posted instructions, but each terminal should be accessible for testing and repair.

As for the computer that houses the online catalog, not all the facts are in. Undoubtedly, the storage capacity and miniaturization of computers encourages decentralization. But local library systems are still very much a possibility. Will your catalog be run on a central machine housed by PALINET or PRLC? Or by a smaller local consortium? Are you large enough to justify an in-house, online computer catalog? These are among the questions you will need to answer. If you decide to house the equipment, a minicomputer will, undoubtedly, be able to handle all but the largest of online catalogs.

As you program and design your building in the next five years, the appropriate computer configuration may become apparent. Right now, all you can do is guess at what will be best for your library.

Classrooms

I think at least a small classroom is appropriate in the library for bibliographic instruction, but that may be an individual campus decision considering the incompatibility of classrooms within a library. However, bear in mind that computer literacy, data base searching and other use of the equipment will become increasingly important for staff. As a result, a conference or lecture room should be programmed for staff training. It must accommodate terminals to microcomputers in the library and have communications, via at least a telephone, to data bases outside.

Exhibit Space

Exhibit space in the library can be trying to the staff but it should be accommodated. Include sufficient duplex outlets and power so that microcomputer and videodisks can present special exhibits and displays including interactive instruction.

New rules and regulations might be posted on a T.V. display, and even a campus-events display might be developed. Program accordingly.

Machine Repair and Photographic Space

Large libraries should plan machine repair space for first-line maintenance of printers and terminals, microfilm readers, printers, and A.V. equipment. Yet service contracts, staff attitudes and the difficulties in filling the maintenance position might preclude it. Give some thought, too, to secure storage of high technology equipment because as more and more of it becomes appropriate, extra pieces will need to be held in reserve.

Microfilm duplication by ultra-violet light and electronic imaging should make a photographic dark room and related space unnecessary.

Non-assignable Space

I cannot see that technology will contribute significantly to the reduction of non-assignable space in the library. As in Kansas City, toilets have "gone about as fer as they can go."

In the long run, there may be some miniaturization of the mechanical equipment housed within the Library for HVAC and electricity. But technologies like co-generation for an uninterruptable power source may add to non-assignable space. Your systems will be designed under the current technology and for the most part, technological improvement will not aid you.

Mitchell's formula,[27] mentioned above, adds one half of the total net square feet as non-assignable. He, therefore, has chosen 33 percent of gross to be non-assignable. Obviously, architects prefer the comfort of this larger figure. Librarians should push for 25 percent of gross.

CONCLUSION

In conclusion, a few caveats as you begin planning for your library building:

Don't believe predictions of the future like this one. Let them be guides but stay alert to new developments and trends.

Maximize the flexibility and adaptability of your building.

Expect most technologies to overlay, not immediately replace the previous ones. We still use books, radio and television.

Be prepared to make errors, especially those of omission.

Remember, it's cheaper to make adjustments later than to accommodate the vast, uncertain future now.

Be aware of the strength of economics as a factor; you'll have trouble enough getting what you want even when you know you need it.

And remember that you have to get to that advanced technological future from here. Design for the foreseeable future and add--flexibility, flexibility, flexibility.

REFERENCES

[1]Porter Driscoll, "Architecture and the Information Revolution," AIA Journal vol. 71 (July 1982): 71.

[2]F. W. Lancaster, Libraries and Librarians in an Age of Electronics (Arlington, Va.: Information Resources Press, 1982), p. 151.

[3]Ibid., p. 150.

[4]Edward M. Walters, "The Future of the Book: A Historian's Perspective," Information Technology and Libraries vol. 1 (March 1982): 15-21; Books, Libraries and Electronics: Essays on the Future of Written Communication by Efrem Sigel, Erik Barnouw, Anthony Smith, Dan Lacey, Robert D. Stueart, Lewis M. Branscomb (White Plains, N.Y.: Knowledge Industry Publications, 1982)

[5]William J. Baumol and Sue Anne Batey Blackman, "Electronics, the Cost Disease, and the Operation of Libraries," Journal of the American Society for Information Science vol. 34 (May 1983): 181-91.

[6]Ibid., p. 189.

[7]May Katzen, ed., Multi-Media Communication (Westport, Conn.: Greenwood Press, 1982), pp. 21-22.

[8]Keyes D. Metcalf, Planning Academic and Research Library Buildings (New York: McGraw-Hill, 1965)

[9]Ralph E. Ellsworth, Planning Manual for Academic Library Buildings (Metuchen, N.J.: Scarecrow Press, 1973)

[10]Ibid., p. 116

[11]Edwin B. Brownrigg, "Library Automation: Building and Equipment Considerations in Implementing Computer Technology," Advances in Library Administration and Organization vol. 1 (Greenwich, Conn.: 1982): 43-53; PALINET and Union Library Catalogue of Pennsylvania, Memorandum "OCLC Terminal Installation and Service Guidelines," Philadelphia, PA [July 1983]; Richard P. Stroum, "Physical Planning for Automated Circulation Systems," LJ Special Report #4 Buying New Technology (New York: Library Journal, 1978): 12-14.

[12]Keyes D. Metcalf, Library Lighting (Washington, D.C.: Association of Research Libraries, 1970)

[13]Brownrigg, Advances in Library Administration and Organization, 1: 50-51.

[14]Edward Balogh, "Protecting Computers Against Fire," Information and Records Management vol. 15 (October, 1981): 24-25.

[15]Mark Mitchell, "The Architect as Library Planner," LJ Special Report #1 Library Space Planning (New York: Library Journal, 1976): 69.

[16]Metcalf, Planning Academic and Research Library Buildings, p. 294; Western Interstate Commission for Higher Education, Planning and Management Systems Division, Manual Four Academic Support Facilities, Higher Education Facilities Planning and Management Manuals, Technical Report 17-4 (Boulder, Colorado: 1971); State University of New York, Office for Campus Development, Space projection criteria for capital and long range facilities planning purposes, Appendix A. Space factors and models (New York: 1970): table VI.

[17]Robert Barrett, "Prospects for the Optical Disk in the Office of the Future," Multi-Media Communications, May Katzen, ed., p. 99.

[18]David J. Brown, "Electronic Document Delivery Systems," Multi-Media Communciations, May Katzen, ed., pp. 68-87.

[19]Ibid., p. 87.

[20]Metcalf, Planning Academic and Research Library Buildings, p. 294.

[21]Western Interstate Commission for Higher Education, Manual Four Academic Support Facilities, p. 22.

[22]Driscoll, AIA Journal, p. 71.

[23]Lancaster, Libraries and Librarians in an Age of Electronics, p. 170.

[24]Peter S. Graham, "Technology and the Online Catalog," Library Resources and Technical Services vol. 27 (Jan./Mar., 1983): 18-35.

[25]Edwin B. Brownrigg and Clifford A. Lynch, "Online Catalogs: Through a Glass Darkly," Information Technology and Libraries vol. 2 (March, 1983): pp. 104-115.

[26]Whitney Knox and Bruce A. Miller, "Predicting the Number of Public Computer Terminals Needed for an On-line Catalog: A Queuing Theory Approach," Library Research vol. 2 (Spring 1980-81): 95-100.

[27]Mitchell, LJ Special Report #1, p. 69.